

TENNESSEE VALLEY AUTHORITY

River Basin Operations
Water Resources

RESULTS OF FISH TISSUE SCREENING STUDIES
FROM SITES IN THE TENNESSEE
AND CUMBERLAND RIVERS
IN 1987

TVA/WR/AB--89/5

Chattanooga, Tennessee

May 1989

ChemRisk Document No. 846

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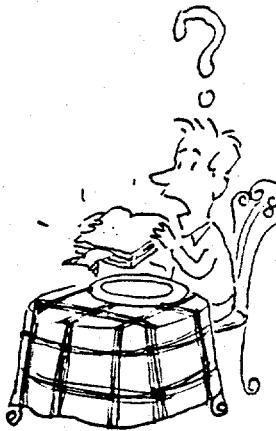
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Donald L. Dycus

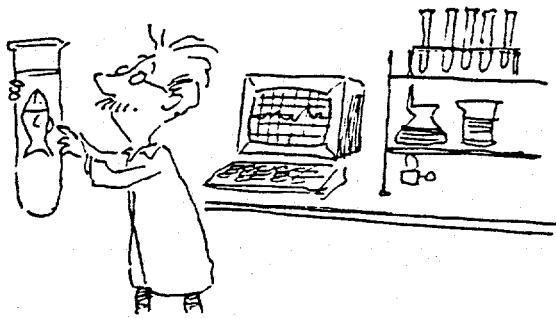
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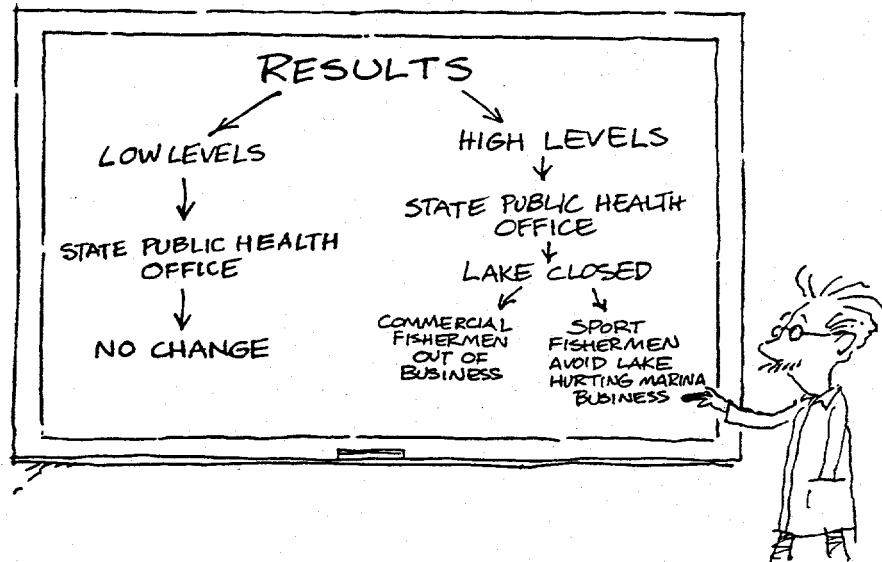
VALLEY-WIDE FISH TISSUE STUDY



You can't tell a fish
by it's cover--is it
safe to eat?



Routine, cooperative monitoring by State, Federal, and other interested agencies is necessary to ensure protection of public health.



Results are provided to all involved parties and are used by State officials to advise the public appropriately.

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RESULTS OF FISH TISSUE SCREENING STUDIES FROM SITES
IN THE TENNESSEE AND CUMBERLAND RIVERS
IN 1987

INTRODUCTION

TVA analyzes tissues of Tennessee Valley area fish as part of two types of evaluations. One is the screening level evaluation and is intended to assess the general, overall level of contamination. The other is the intensive evaluation intended to delineate problem areas where contamination levels may warrant limiting fish consumption to protect human health. Studies are conducted in conjunction with State agencies because they must make the decisions regarding fish consumption advisories. Two examples of intensive studies are the recently completed trend study on Wilson Reservoir in Alabama and the continuing study on Fort Loudoun Reservoir in Tennessee. Results of intensive studies are provided in detailed technical reports specific to each study.

TVA has two screening programs and the combined data from these programs provide a fairly comprehensive assessment of fish contamination in the Tennessee valley. One program examines fish on an annual basis at inflow points from eight of the major tributaries into the Tennessee River reservoir system. The other program examines fish from the reservoirs themselves on a rotating basis with the goal of sampling each reservoir at least once every three years.

This report presents the 1987 results from these two screening programs. To avoid confusion between these two programs the annual samples at inflow points will be identified as Fish Tissue-Inflow (FT-I)

and the reservoir samples will be identified as Fish Tissue-Reservoirs (FT-R).

It is necessary to differentiate between the two studies because they have different objectives and slightly different protocols. FT-I is intended to identify year-to-year trends of contaminants (toxics) entering the reservoir system from major watersheds using tissue from catfish, rough fish and game fish as the indicator tool. This program started in 1986 and results were provided in an earlier report (TVA 1986a). Results for the second year are provided in this report.

FT-R is a broad screening study with the objective of conducting an efficient monitoring program to screen toxics levels in fish from throughout the Tennessee Valley through coordination with other organizations involved in such studies. Communication with State, Federal, and industrial biologists avoids duplication of effort. Also, the FT-R study depends on biologists from other organizations to supply at least half the fish for analysis, whereas TVA collects fish from the remaining sites, analyzes all fish, and provides results to the cooperating groups.

Results from FT-R are intended to lead to one of three alternatives. If all values for toxics in fish flesh are low, that location would be reexamined in about three years. If high, that location would be recommended for intensive study with details and funding sources developed by all involved organizations. If levels of toxics are between these extremes, that location would be revisited the next year and resampled at the screening level to ensure that a problem does not exist. Values termed low and high were selected a priori from a combination of sources including Food and Drug Administration (FDA) tolerances and

action levels (FDA 1987), Preliminary Guidance Values described in Travis et al (1986), and subjective evaluation based on experience with such studies in the Tennessee Valley. The low (Tier 1) and high (Tier 2) levels for each parameter included in this study are in table 1.

Results of fish tissue studies conducted in 1987 as part of programs other than the two screening efforts summarized here have been reported separately. These include Wilson Reservoir (TVA 1988b); Guntersville Reservoir (TVA 1988 draft); Chickamauga Reservoir (TVA 1988); and Fort Loudoun, Tellico, and Watts Bar Reservoirs (in preparation).

PROCEDURES AND RATIONALE

Collection Sites

Collection sites for FT-I and FT-R are shown in figure 1 and appendix A. It should be emphasized that the eight FT-I sites represent an annual effort at the same locations, whereas FT-R sites rotate from year to year. Figure 1 highlights FT-I and FT-R sites planned for collection in 1987. Appendix A identifies river mile locations for each collection site and shows availability of historic information for each site. Appendix A also identifies those sites which were sampled in 1987 as part of other studies referenced previously.

Study Species

Fish collected for analysis for FT-I include game fish, catfish, and rough fish. Species in order of preference within each category are listed below. If five individuals of the most preferred species within a category could not be collected, individuals from the next preferred species were substituted to achieve the full complement of five.

<u>Game</u>	<u>Catfish</u>	<u>Rough</u>
Largemouth bass	Channel	Carp
Crappies	Blue	Freshwater drum
Spotted bass	Flathead	Buffalos
Smallmouth bass	Bullhead	Redhorses
Bluegill		
Other sunfishes		

Because FT-R is a broad screening effort, use of a single indicator species was chosen to allow greatest coverage of the valley at the lowest possible cost. Channel catfish was selected because it is highly sought by commercial and sport fisherman and because individuals typically have high levels of most toxics relative to other species. Five channel catfish (supplemented by blue catfish only as a last resort) was the desired number for collection at each site.

Sample Processing

Following collection all fish are immediately placed on ice until processing. Prior to processing each fish is measured, weighed and external condition noted. All fish are filleted with care being taken to get all flesh. Ribs and belly flap are left on the fillet. Fish sex and condition of internal organs are noted during filleting. Skin is left on game fish and rough fish (scales removed), but skin is removed from catfish. Fillets are rinsed in cold water, weighed, individually wrapped in aluminum foil, and placed in separate, labeled plastic bags. Samples are frozen immediately following processing and stored frozen until laboratory analyses.

Laboratory Analyses

Laboratory analyses are based on composited fillets (five fish per composite) where each fillet is individually homogenized and an

equal aliquot withdrawn from each fillet to prevent size bias. Analyses include lipid content and priority pollutant metals, pesticides, and PCBs (table 1 and appendix B). For those organics where the Environmental Protection Agency (EPA) priority pollutant list includes more than one isomer or metabolite (e.g., alpha, beta, and gamma BHC or endrin and endrin aldehyde), these are analyzed separately in the laboratory but reported herein as a total value. All data are stored on EPA's STORET system.

RESULTS AND DISCUSSION

Information for each of the 219 fish included in 1987 collections is provided in table 2. This includes collection date, species, sex, lab identification number, length, and weight. The lab identification number (shown as LABID) is the mechanism used to relate physical information in table 2 to information on tissue levels of metals and organics provided in tables 3 and 4, respectively. Fish with the same LABID number in table 2 were composited for laboratory analysis.

Fish were not collected from all sites planned for collection in 1987. This was due to lack of effort, not absence of fish, primarily because TVA requested assistance from State agencies too late in the year for them to alter planned activities. (This problem will be alleviated by communicating with State agencies earlier in the year.) Catfish were not collected at eight of the FT-R sites planned for collection in 1987 (figure 2). These sites will be identified in a later section of this report on planned collections for autumn 1988. Five catfish were collected at the remaining FT-R sites except Normandy Reservoir (DRM 251) where only two were collected and Nottely Reservoir (NRM 27) where three

were collected (table 3). The full complement of fish was collected from all FT-I sites except the Duck River site (DRM 18.5) where no fish were collected (again from lack of effort) and the Elk River site (ERM 31.0) were three each rather than five each of game, cat, and rough fish were collected (table 2).

External examination of these fish indicated all except one individual were healthy and had no noteworthy condition. The one exception was a channel catfish from Tims Ford Reservoir (ERM 135) which was noted as being "skinny for its age". Observations on internal organs indicated some fish (12) had parasites but were otherwise healthy. All ten catfish from the Cumberland River sites (mid and upper Barkley Reservoir) had parasites compared to only two from the Tennessee River sites (one each from Melton Hill Reservoir and Douglas Reservoir). These results indicate fairly healthy populations of those species examined, but the consistency of parasite infestation in Cumberland River channel catfish may need further investigation if observed in subsequent collections.

Table 3 provides results of laboratory analyses for metals on the 46 composited fillet samples. Antimony, beryllium, nickel, silver, and thallium were not detected in any samples. Zinc, an essential element, was the only metal found in all samples, although selenium was found in all but one sample. Comparison of metals concentrations to the a priori Tier 1 and Tier 2 levels in table 1 shows that few samples exceeded Tier 1 levels and none exceed Tier 2 levels (table 5). Mercury was found at or near the Tier 1 level of 0.5 µg/g at Elk River mile 31.0 (0.5 µg/g), Hiwassee River mile 14.0 (0.4 µg/g), and Little Tennessee River mile 81 (0.5 µg/g). The Elk River and Hiwassee River

sites are part of FT-I and will automatically be sampled again in 1988. The Little Tennessee River site is part of FT-R and will be recommended for resampling at the Tier 1 level in 1988 as will its counterpart site in Fontana Reservoir at Little Tennessee River mile 62.5. Selenium concentrations (0.83 $\mu\text{g/g}$) from Ocoee River mile 12 (Parksville Reservoir, a FT-R site) were sufficiently close to the Tier 1 level of 1.0 $\mu\text{g/g}$ to recommend resampling in 1988, especially considering the historical problems in that reservoir.

Cadmium in fish from Holston River mile 110 was identified as noteworthy in the first report on FT-I sites (TVA 1988a). The maximum cadmium concentration observed in fish collected from that site in the most recent sampling (1987) was 0.01 $\mu\text{g/g}$ in the catfish sample compared to 0.48 $\mu\text{g/g}$ in the rough fish sample collected in 1986. Two years of information is not sufficient to allow speculation on causes of this observed variation.

Table 4 provides results from pesticide and PCB analyses. The only pesticides detected were isomers of DDT and chlordane. DDT was found in 34 of the 46 samples, although it was always found at low levels. The maximum concentration of DDTr (sum of all DDT isomers) was 0.92 $\mu\text{g/g}$, well below the FDA action level of 5.0 $\mu\text{g/g}$ and the Tier 1 level of 2.0 $\mu\text{g/g}$. Chlordane, present in 33 of the 46 samples, was found in some samples at concentrations high enough to be of concern (table 5). Chlordane concentrations equal to or above the Tier 1 level of 0.1 $\mu\text{g/g}$ were found at the following locations: Normandy Reservoir at Duck River mile 251 (0.10 $\mu\text{g/g}$); Hiwassee River mile 14.0 (0.15 $\mu\text{g/g}$); and Melton Hill Reservoir sites, Clinch River mile 24 and 39 (0.16 $\mu\text{g/g}$ at each site). The Tier 2 level of 0.2 $\mu\text{g/g}$ was exceeded

at both Nickajack Reservoir sites at Tennessee River mile 425 and 457 (0.21 and 0.25, respectively), and from the Melton Hill Dam tailwaters at Clinch River mile 20 (0.25 $\mu\text{g/g}$). Sites where chlordane levels exceeded the Tier 1 level fit into the category for resampling in autumn 1988 at the screening level. Sites which exceeded the Tier 2 level need investigation beyond the screening level. At the time this report was in preparation, cooperative efforts were underway to conduct more intensive studies (analysis of individual fish from several locations) on Nickajack and Melton Hill Reservoirs by the Tennessee Division of Water Pollution Control, Tennessee Wildlife Resources Agency, TVA, and Oak Ridge National Laboratory.

PCBs were found in 25 of the 46 samples. Concentrations at 15 sites approached or exceeded Tier 1 and 2 levels (tables 1 and 5). Because of the lengthy list, those 15 locations are not itemized here. Sites where samples approached or exceeded the Tier 1 level were resampled in autumn 1988. Sites which exceeded the Tier 2 level are the same as for chlordane (except for one site at Hiwassee River mile 14.0), and PCBs will be included in the intensive studies referenced above. The Hiwassee River site was automatically resampled in 1988 because it is a FT-I site. To verify that both chlordane and PCBs were present in these samples, selected extracts were analyzed for chlordane using the gas chromatograph/mass spectrum qualitative tool. Presence of chlordane was confirmed using this technique.

Samples from FT-I sites in 1986 had PCBs above 1.0 $\mu\text{g/g}$ at two sites--Elk River mile 31.0 and Holston River mile 110 (TVA 1988a). Sampling at those sites in 1987 confirmed presence of relatively high levels of PCBs. The Holston River location may be of special concern

because concentrations observed in 1986 (1.8 µg/g in rough fish) and 1987 (1.6 µg/g in catfish) exceed the Tier 2 level, and because this site is at the headwaters of John Sevier Detention Reservoir which receives substantial fishing pressure. No specific plans have been established to intensively examine this site.

Table 6 summarizes the highest and second highest levels of contaminants to help identify "worst-case" locations and to determine if any location frequently had high levels of contaminants. There is no location which stands out from the others, although the high levels of PCBs and chlordane from Nickajack Reservoir sites and the Melton Hill Dam tailwater site are discernable in this table.

The report for the first year of the FT-I study (1986) identified Holston River mile 110.0 to be the one site which appeared most frequently in a similar table for those data (TVA 1988a). Absence of this observation for 1987 data is probably due to adding 25 collection sites rather than improved conditions because comparison of data for this site from 1986 and 1987 shows some parameters increased and some decreased with no consistent trend. Of particular interest the decrease in cadmium is highly desirable, however, the occurrence of chlordane is equally undesirable.

RECOMMENDATIONS

Special attention and possibly more thorough sampling is needed at three FT-I sites: (1) Elk River mile 31.0, (2) Hiwassee River mile 14.0, and (3) Holston River mile 110.0. The site at Holston River mile 110.0 should receive highest priority because of the substantial amount of

fishing that occurs in the small reservoir immediately downstream from that site. The Hiwassee River site is already being more thoroughly evaluated by EPA in their National Bioaccumulation Study, and TVA will maintain close contact with EPA. The Elk River site probably is the lowest priority of these three sites, based on the assumption that there is little utilization of the fishery in that stretch of the river. However, that site is worthy of more intensive work to evaluate the possible influence of inflow from the Elk River on PCB problems observed in downstream reservoirs in past years.

Planning for 1988 fish collections for FT-R was essentially completed at the time this report was prepared. As previously stated, intensive studies were underway on Nickajack and Melton Hill Reservoirs because of possible PCB and chlordane problems. Sites for FT-R collections in autumn 1988 are identified in table 7 and figure 3. Fish for reservoir screening purposes were to be collected from 33 sites. Seven are being resampled because one or more contaminants were found to exceed the tier 1 level in 1987. Eight of the sites were planned for collection in 1987 but for one reason or another no fish were collected. The remaining 18 sites have not been sampled in the past three years and, therefore, are in need of evaluation.

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FIGURES

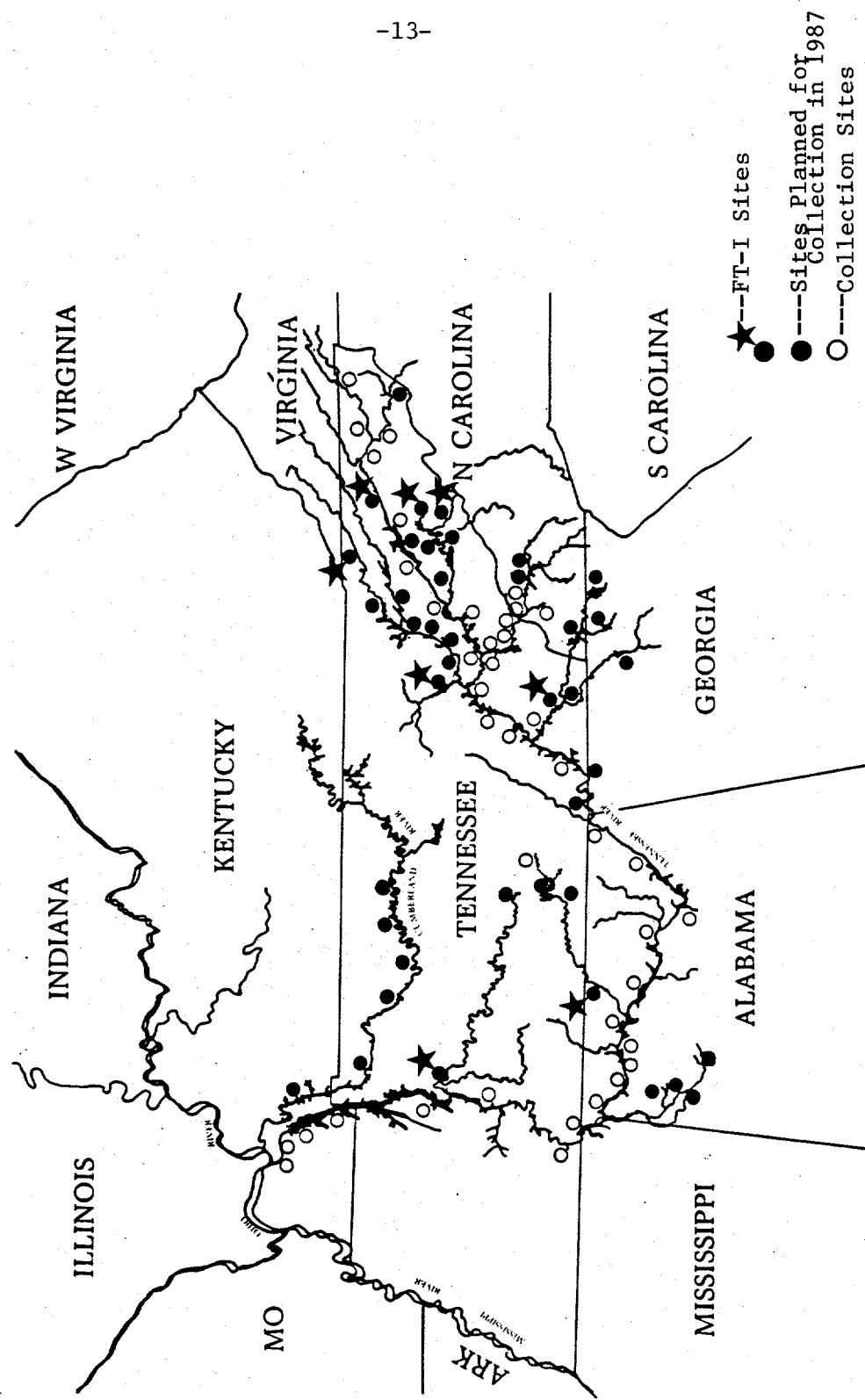


Figure 1. Collection Sites for Fish Tissues Screening Studies of Inflow and Reservoir Locations.

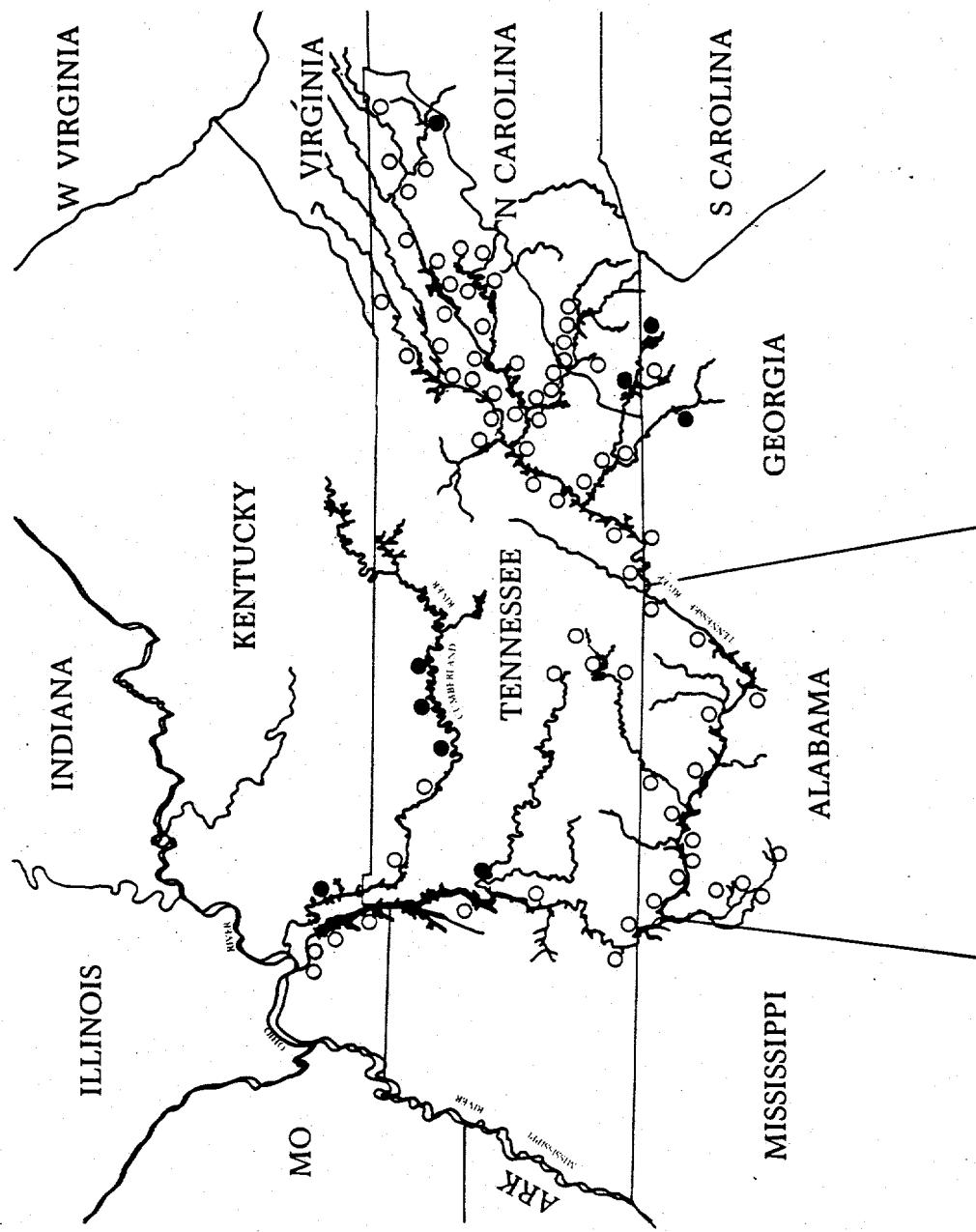


Figure 2. Sites Planned for Fish Tissue Screening in 1987 Yet Locations Were Not Made.

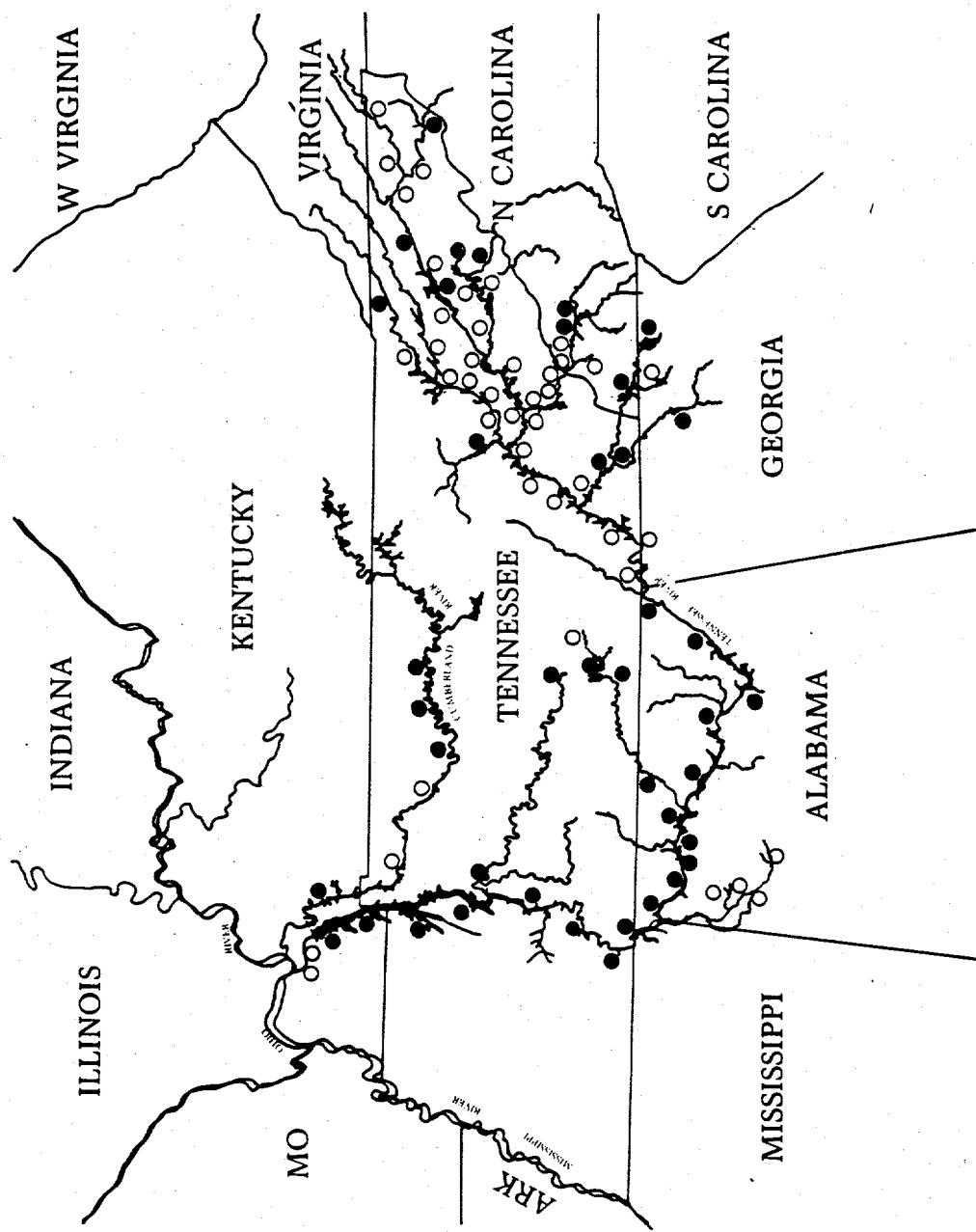


Figure 3. Sites Planned for Fish Tissue Collections for Screening Purposes in 1988.

TABLES

Table I. Contaminant Levels^a Used to Make Recommendations Based on Analytical Results from Valley-Wide Fish Tissue Screening Study

Parameter	Laboratory Detection Limit	Tier 1	Tier 2	Tier 3
	(µg/g)	Return to Rotation System (µg/g)	Resample at Screening Level Following Year (µg/g)	Recommend Intensive Study (µg/g)
Antimony	2.0	< 5.0	≥ 5.0	b
Arsenic	0.03	< 0.5	≥ 0.5	≥ 0.7
Beryllium	0.02	< 0.1	≥ 0.1	≥ 0.3
Cadmium	0.001	< 0.5	≥ 0.5	≥ 1.0
Chromium	0.02	< 0.7	≥ 0.7 ^c	≥ 1.5 ^c
Copper	0.2	< 3.0	≥ 3.0	b
Lead	0.2	< 1.5	≥ 1.5	≥ 2.0
Mercury	0.1	< 0.5	≥ 0.5	≥ 0.7
Nickel	1.0	< 2.0	≥ 2.0 ^c	≥ 4.0 ^c
Selenium	0.02	< 1.0	≥ 1.0	≥ 3.0
Silver	0.2	< 12.0	≥ 12.0	b
Thallium	1.0	< 1.0	≥ 1.0	≥ 3.0
Zinc	0.1	< 75.0	≥ 75.0	b
Aldrin	0.01	< 0.1	≥ 0.1	≥ 0.2
Benzene Hexachloride	0.01	< 0.1	≥ 0.1	≥ 0.2
Chlordane	0.01	< 0.1	≥ 0.1	≥ 0.2
DDT	0.01	< 2.0	≥ 2.0	≥ 4.0
Dieldrin	0.01	< 0.1	≥ 0.1	≥ 0.2
Endosulfan	0.01	< 3.0	≥ 3.0	≥ 5.0
Endrin	0.01	< 0.1	≥ 0.1	≥ 0.2
Heptachlor	0.01	< 0.1	≥ 0.1	≥ 0.2
Toxaphene	0.5	< 2.0	≥ 2.0	≥ 3.0
PCB's	0.1	< 1.0	≥ 1.0	≥ 1.5

- a. These levels will be used as a general guide. Specific recommendations will be made on a case-by-case basis.
- b. Selection of a level of this metal which would result in a recommendation to conduct intensive studies cannot be made at this time.
- c. Chromium and nickel frequently occur as a result of laboratory contamination from the blending process. A suspected source would have to exist before further examination would be recommended based only on these metals.

Table 2. Physical Information Specific to Each Fish Collected
for Tissue Analysis from Inflow and Reservoir Locations

Collection site	Date	Species ^a	Sex ^b	LABID ^c	Length (mm)	Weight (g)
Normandy Reservoir						
Duck River mile 251.5	87/09/09	CHC	F	1135	580	1840
Duck River mile 251.5	87/09/09	CHC	M	1135	590	2050
Bear Creek Reservoir						
Bear Creek mile 76.9	87/11/03	CHC	F	1143	350	400
Bear Creek mile 76.9	87/11/03	CHC	F	1143	310	300
Bear Creek mile 76.9	87/11/03	CHC	F	1143	300	320
Bear Creek mile 76.9	87/11/03	CHC	F	1143	340	410
Bear Creek mile 76.9	87/11/03	CHC	M	1143	270	210
Upper Bear Creek Reservoir						
Bear Creek mile 114.8	87/11/03	CHC	F	1142	465	948
Bear Creek mile 114.8	87/11/03	CHC	F	1142	335	358
Bear Creek mile 114.8	87/11/03	CHC	F	1142	340	470
Bear Creek mile 114.8	87/11/03	CHC	M	1142	335	268
Bear Creek mile 114.8	87/11/03	CHC	M	1142	320	400
Little Bear Creek Reservoir						
Little Bear Creek mile 12.5	87/11/20	CHC	F	1141	355	312
Little Bear Creek mile 12.5	87/11/20	CHC	F	1141	440	662
Little Bear Creek mile 12.5	87/11/20	CHC	F	1141	420	574
Little Bear Creek mile 12.5	87/11/20	CHC	F	1141	580	1620
Little Bear Creek mile 12.5	87/11/20	CHC	M	1141	480	972
Cedar Creek Reservoir						
Cedar Creek mile 38.0	87/11/18	CHC	F	1140	365	372
Cedar Creek mile 38.0	87/11/18	CHC	F	1140	360	348
Cedar Creek mile 38.0	87/11/18	CHC	F	1140	325	236
Cedar Creek mile 38.0	87/11/18	CHC	F	1140	350	288
Cedar Creek mile 38.0	87/11/18	CHC	F	1140	390	456
Wheeler Reservoir						
Elk River mile 31.0	87/06/11	CHC	F	1270	365	380
Elk River mile 31.0	87/06/12	CHC	F	1270	432	664
Elk River mile 31.0	87/06/12	CHC	M	1270	532	1152
Elk River mile 31.0	87/06/11	LMB	M	1271	380	806
Elk River mile 31.0	87/06/11	LMB	M	1271	412	942
Elk River mile 31.0	87/06/11	LMB	M	1271	292	364
Elk River mile 31.0	87/06/11	SMB	F	1272	552	2396
Elk River mile 31.0	87/06/11	SMB	F	1272	520	2324
Elk River mile 31.0	87/06/11	SMB	F	1272	452	1274

Table 2. (Continued)

Collection site	Date	Species ^a	Sex ^b	LABID ^c	Length (mm)	Weight (g)
Tims Ford Reservoir						
Elk River mile 135.0	87/12/02	CHC	F	1136	372	338
Elk River mile 135.0	87/12/02	CHC	F	1136	336	266
Elk River mile 135.0	87/12/03	CHC	F	1136	380	362
Elk River mile 135.0	87/12/02	CHC	M	1136	465	886
Elk River mile 135.0	87/12/02	CHC	M	1136	461	786
Elk River mile 150.0	87/10/28	CHC	F	1139	510	1776
Elk River mile 150.0	87/10/28	CHC	F	1139	450	746
Elk River mile 150.0	87/10/28	CHC	M	1139	425	648
Elk River mile 150.0	87/10/28	CHC	M	1139	555	2134
Elk River mile 150.0	87/10/28	CHC	M	1139	440	718
Nickajack Reservoir						
Tennessee River mile 425.0	86/12/31	BLC	F	1130	572	2110
Tennessee River mile 425.0	86/12/31	BLC	F	1130	526	1463
Tennessee River mile 425.0	86/12/31	BLC	F	1130	495	1160
Tennessee River mile 425.0	86/12/31	BLC	I	1130	291	218
Tennessee River mile 425.0	86/12/31	BLC	I	1130	447	800
Tennessee River mile 457.0	86/10/24	CHC	F	1129	607	2750
Tennessee River mile 457.0	86/10/24	CHC	F	1129	406	636
Tennessee River mile 457.0	86/10/24	CHC	F	1129	453	861
Tennessee River mile 457.0	86/10/24	CHC	M	1129	471	950
Tennessee River mile 457.0	86/10/24	CHC	M	1129	536	1810
Chickamauga Reservoir						
Hiwassee River mile 14.0	87/07/29	LMB	F	1273	326	545
Hiwassee River mile 14.0	87/07/29	LMB	F	1273	301	379
Hiwassee River mile 14.0	87/07/29	LMB	F	1273	418	1090
Hiwassee River mile 14.0	87/07/29	LMB	F	1273	506	1981
Hiwassee River mile 14.0	87/07/29	LMB	F	1273	327	406
Hiwassee River mile 14.0	87/09/09	CHC	F	1274	403	437
Hiwassee River mile 14.0	87/09/09	CHC	F	1274	341	303
Hiwassee River mile 14.0	87/09/10	CHC	F	1274	466	752
Hiwassee River mile 14.0	87/09/10	CHC	F	1274	602	430
Hiwassee River mile 14.0	87/08/07	FHC	F	1274	530	2375
Hiwassee River mile 14.0	87/07/29	C	F	1275	647	4290
Hiwassee River mile 14.0	87/07/29	C	F	1275	596	3210
Hiwassee River mile 14.0	87/07/29	C	M	1275	592	2980
Hiwassee River mile 14.0	87/07/29	C	M	1275	593	2830
Hiwassee River mile 14.0	87/07/29	C	M	1275	481	1561
Nottely Reservoir						
Nottely River mile 27.5	87/12/08	CHC	F	1131	352	357
Nottely River mile 27.5	87/12/08	CHC	F	1131	499	1109
Nottely River mile 27.5	87/12/08	CHC	F	1131	451	815

Table 2. (Continued)

Collection site	Date	Species ^a	Sex ^b	LABID ^c	Length (mm)	Weight (g)
Parksville Reservoir						
Ocoee River mile 12.0	87/09/18	CHC	F	1132	492	868
Ocoee River mile 12.0	87/09/18	CHC	F	1132	484	937
Ocoee River mile 12.0	87/09/18	CHC	F	1132	455	944
Ocoee River mile 12.0	87/09/18	CHC	F	1132	452	847
Ocoee River mile 12.0	87/09/18	CHC	M	1132	421	546
Watts Bar Reservoir						
Clinch River mile 20.0	87/12/04	CHC	F	1147	345	729
Clinch River mile 20.0	87/12/04	CHC	F	1147	465	1026
Clinch River mile 20.0	87/12/04	CHC	F	1147	490	1021
Clinch River mile 20.0	87/12/04	CHC	F	1147	425	617
Clinch River mile 20.0	87/12/04	CHC	M	1147	450	762
Emory River mile 10.0	87/07/28	C	F	1285	535	2241
Emory River mile 10.0	87/07/28	C	F	1285	581	2972
Emory River mile 10.0	87/07/28	C	M	1285	485	1522
Emory River mile 10.0	87/07/28	C	M	1285	480	1409
Emory River mile 10.0	87/07/28	C	M	1285	508	1805
Emory River mile 10.0	87/07/28	LMB	F	1286	309	386
Emory River mile 10.0	87/07/28	LMB	F	1286	340	503
Emory River mile 10.0	87/07/28	LMB	F	1286	278	367
Emory River mile 10.0	87/07/28	LMB	M	1286	231	161
Emory River mile 10.0	87/07/28	SPB	F	1286	294	296
Emory River mile 10.0	87/07/28	BLC	M	1287	580	1620
Emory River mile 10.0	87/07/28	BLC	M	1287	730	4640
Emory River mile 10.0	87/07/28	CHC	F	1287	438	619
Emory River mile 10.0	87/07/28	CHC	F	1287	417	551
Emory River mile 10.0	87/07/28	CHC	M	1287	665	3150
Melton Hill Reservoir						
Clinch River mile 24.0	87/11/25	CHC	F	1146	352	404
Clinch River mile 24.0	87/11/25	CHC	F	1146	352	413
Clinch River mile 24.0	87/11/25	CHC	F	1146	514	1265
Clinch River mile 24.0	87/11/25	CHC	F	1146	413	581
Clinch River mile 24.0	87/11/25	CHC	I	1146	266	148
Clinch River mile 39.0	87/11/25	CHC	F	1145	414	552
Clinch River mile 39.0	87/11/25	CHC	F	1145	448	701
Clinch River mile 39.0	87/11/25	CHC	F	1145	360	413
Clinch River mile 39.0	87/11/25	CHC	M	1145	463	851
Clinch River mile 39.0	87/11/25	CHC	M	1145	421	603

Table 2. (Continued)

Collection site	Date	Species ^a	Sex ^b	LABID ^c	Length (mm)	Weight (g)
Norris Reservoir						
Clinch River mile 118.8	87/08/18	CHC	F	1153	390	495
Clinch River mile 118.8	87/08/18	CHC	M	1153	420	667
Clinch River mile 118.8	87/08/18	CHC	M	1153	589	707
Clinch River mile 118.8	87/08/18	CHC	M	1153	345	410
Clinch River mile 118.8	87/08/18	CHC	M	1153	347	351
Cove Creek mile 1.0	87/11/19	CHC	F	1144	336	336
Cove Creek mile 1.0	87/11/19	CHC	F	1144	381	478
Cove Creek mile 1.0	87/11/19	CHC	F	1144	441	703
Cove Creek mile 1.0	87/11/19	CHC	M	1144	334	297
Cove Creek mile 1.0	87/11/19	CHC	M	1144	410	557
Powell River mile 34.0	87/10/04	CHC	F	1152	454	751
Powell River mile 34.0	87/07/01	CHC	M	1152	450	834
Powell River mile 34.0	87/07/01	CHC	M	1152	370	408
Powell River mile 34.0	87/07/15	CHC	M	1152	350	292
Powell River mile 34.0	87/07/15	CHC	M	1152	328	258
Powell River						
Powell River mile 65.3	87/06/10	CHC	F	1276	380	562
Powell River mile 65.3	87/06/10	CHC	F	1276	474	1082
Powell River mile 65.3	87/06/10	CHC	F	1276	386	486
Powell River mile 65.3	87/06/10	CHC	M	1276	463	940
Powell River mile 65.3	87/06/10	CHC	M	1276	390	526
Powell River mile 65.3	87/06/10	C	M	1277	686	5000
Powell River mile 65.3	87/06/10	SRD	F	1277	355	467
Powell River mile 65.3	87/06/10	SRD	F	1277	283	224
Powell River mile 65.3	87/06/10	SRD	M	1277	375	527
Powell River mile 65.3	87/06/10	SRD	M	1277	388	546
Powell River mile 65.3	87/06/10	SPB	F	1278	279	275
Powell River mile 65.3	87/06/10	SPB	F	1278	310	462
Powell River mile 65.3	87/06/10	SPB	F	1278	332	472
Powell River mile 65.3	87/06/10	SPB	F	1278	263	316
Powell River mile 65.3	87/06/10	SPB	F	1278	234	194
Fontana Reservoir						
Little Tennessee River mile 62.5	87/09/23	CHC	F	1128	411	511
Little Tennessee River mile 62.5	87/09/23	CHC	F	1128	418	512
Little Tennessee River mile 62.5	87/09/23	CHC	F	1128	369	342
Little Tennessee River mile 62.5	87/09/23	CHC	F	1128	355	317
Little Tennessee River mile 62.5	87/09/23	CHC	M	1128	405	470
Little Tennessee River mile 81.0	87/09/23	CHC	F	1127	359	296
Little Tennessee River mile 81.0	87/09/23	CHC	M	1127	588	1682
Little Tennessee River mile 81.0	87/09/23	CHC	M	1127	651	2148
Little Tennessee River mile 81.0	87/09/23	CHC	M	1127	396	471
Little Tennessee River mile 81.0	87/09/23	CHC	M	1127	407	452

Table 2. (Continued)

Collection site	Date	Species ^a	Sex ^b	LABID ^c	Length (mm)	Weight (g)
Douglas Reservoir						
French Broad River mile 35.0	88/01/14	BLC	F	1149	464	969
French Broad River mile 35.0	88/01/15	BLC	F	1149	460	880
French Broad River mile 35.0	88/01/15	BLC	F	1149	428	764
French Broad River mile 35.0	88/01/13	BLC	M	1149	505	1083
French Broad River mile 35.0	88/01/14	BLC	M	1149	453	777
French Broad River mile 42.0	88/01/13	CHC	F	1150	464	1099
French Broad River mile 42.0	88/01/13	CHC	F	1150	360	392
French Broad River mile 42.0	88/01/13	CHC	M	1150	563	2009
French Broad River mile 42.0	88/01/13	CHC	M	1150	453	847
French Broad River mile 42.0	88/01/13	CHC	M	1150	487	1272
French Broad River mile 55.0	88/01/22	CHC	F	1151	429	743
French Broad River mile 55.0	88/01/22	CHC	F	1151	395	533
French Broad River mile 55.0	88/02/02	CHC	F	1151	446	806
French Broad River mile 55.0	88/02/02	CHC	F	1151	416	768
French Broad River mile 55.0	88/02/02	CHC	M	1151	413	720
French Broad River mile 71.4	87/09/22	LMB	F	1279	523	2325
French Broad River mile 71.4	87/09/22	LMB	F	1279	336	582
French Broad River mile 71.4	87/09/22	LMB	F	1279	396	1122
French Broad River mile 71.4	87/09/22	LMB	M	1279	452	1643
French Broad River mile 71.4	87/09/22	LMB	M	1279	323	520
French Broad River mile 71.4	87/09/22	C	F	1280	496	1655
French Broad River mile 71.4	87/09/22	C	M	1280	469	1250
French Broad River mile 71.4	87/09/22	C	M	1280	463	1180
French Broad River mile 71.4	87/09/22	C	M	1280	446	1140
French Broad River mile 71.4	87/09/22	C	M	1280	467	1339
French Broad River mile 71.4	87/09/22	CHC	F	1281	293	177
French Broad River mile 71.4	87/09/22	CHC	M	1281	436	691
French Broad River mile 71.4	87/09/22	CHC	M	1281	395	521
French Broad River mile 71.4	87/09/22	CHC	M	1281	385	420
French Broad River mile 71.4	87/09/22	CHC	M	1281	276	155
Nolichucky River mile 5.3	87/09/22	C	F	1288	533	1875
Nolichucky River mile 5.3	87/09/22	C	F	1288	635	3562
Nolichucky River mile 5.3	87/09/22	C	M	1288	590	2836
Nolichucky River mile 5.3	87/09/22	C	M	1288	524	1802
Nolichucky River mile 5.3	87/09/22	C	M	1288	566	2483
Nolichucky River mile 5.3	87/09/22	LMB	F	1289	457	1505
Nolichucky River mile 5.3	87/09/22	LMB	F	1289	420	1216
Nolichucky River mile 5.3	87/09/22	LMB	F	1289	381	816
Nolichucky River mile 5.3	87/09/22	LMB	F	1289	310	483
Nolichucky River mile 5.3	87/09/22	LMB	M	1289	409	965
Nolichucky River mile 5.3	87/09/22	CHC	F	1290	374	369
Nolichucky River mile 5.3	87/09/22	CHC	F	1290	364	360
Nolichucky River mile 5.3	87/09/22	CHC	F	1290	472	1081
Nolichucky River mile 5.3	87/09/22	CHC	F	1290	368	365
Nolichucky River mile 5.3	87/09/22	CHC	M	1290	354	372

Table 2. (Continued)

Collection site	Date	Species ^a	Sex ^b	LABID ^c	Length (mm)	Weight (g)
Cherokee Reservoir						
Holston River mile 74.0	87/11/12	CHC	F	1148	371	382
Holston River mile 74.0	87/11/12	CHC	F	1148	325	273
Holston River mile 74.0	87/11/12	CHC	F	1148	357	414
Holston River mile 74.0	87/11/12	CHC	M	1148	450	832
Holston River mile 74.0	87/11/12	CHC	M	1148	337	303
John Sevier Detention Reservoir						
Holston River mile 110.0	87/07/06	LMB	F	1282	287	360
Holston River mile 110.0	87/07/06	LMB	F	1282	273	353
Holston River mile 110.0	87/07/06	LMB	M	1282	337	594
Holston River mile 110.0	87/07/06	LMB	M	1282	293	336
Holston River mile 110.0	87/07/06	LMB	I	1282	217	124
Holston River mile 110.0	87/07/06	C	F	1283	449	1360
Holston River mile 110.0	87/07/06	C	F	1283	443	1365
Holston River mile 110.0	87/07/06	C	F	1283	510	1968
Holston River mile 110.0	87/07/06	C	M	1283	490	1918
Holston River mile 110.0	87/07/06	C	I	1283	395	1035
Holston River mile 110.0	87/07/06	BLC	F	1284	562	2334
Holston River mile 110.0	87/07/06	BLC	M	1284	472	1160
Holston River mile 110.0	87/07/06	CHC	F	1284	574	1897
Holston River mile 110.0	87/07/06	CHC	F	1284	540	1554
Holston River mile 110.0	87/07/06	CHC	M	1284	453	917
Barkley Reservoir						
Cumberland River, midstream	87/12/16	CHC	F	1133	357	306
Cumberland River, midstream	87/12/16	CHC	M	1133	353	326
Cumberland River, midstream	87/12/16	CHC	M	1133	382	362
Cumberland River, midstream	87/12/16	CHC	M	1133	368	382
Cumberland River, midstream	87/12/16	CHC	M	1133	350	298
Cumberland River, upstream	87/12/16	CHC	F	1134	365	378
Cumberland River, upstream	87/12/16	CHC	M	1134	373	412
Cumberland River, upstream	87/12/16	CHC	M	1134	376	436
Cumberland River, upstream	87/12/16	CHC	M	1134	438	596
Cumberland River, upstream	87/12/16	CHC	M	1134	391	508

a. Species Abbreviations: CHC=channel catfish; BLC=blue catfish; FHC=flathead catfish; LMB=largemouth bass; SMB=smallmouth bass; SPB=spotted bass; C=carp; SRD=shorthead redhorse.

b. F=female; M=male; I=immature.

c. The LABID (laboratory identification) number is the mechanism used to relate physical information in table 2 to information on tissue levels of metals in table 3 and organics in table 4. Fish with the same LABID number in this table were composited for laboratory analysis.

Table 3. Concentrations ($\mu\text{g/g}$) of Metals in Composited Flesh Fish Samples from Inflow and Reservoir Locations

Collection Site	Species ^a	LAIBD	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Normandy Reservoir Duck River mile 251.5	CHC	1135	2.00K ^b	0.03	0.02K	0.00	0.02K	0.60	0.02K	0.27	1.00K	0.16	0.20K	1.00K	5.60
Bear Creek Reservoir Bear Creek mile 76.9	CHC	1143	2.00K	0.02K	0.02K	0.00	0.02K	0.40	0.02K	0.10K	1.00K	0.11	0.20K	1.00K	5.00
Upper Bear Creek Reservoir Bear Creek mile 114.8	CHC	1142	2.00K	0.02K	0.02K	0.00K	0.02K	0.20K	0.02K	0.11	1.00K	0.20	0.20K	1.00K	4.80
Little Bear Creek Reservoir Little Bear Creek mile 12.5	CHC	1141	2.00K	0.02K	0.02K	0.00K	0.02K	0.80	0.02	0.14	1.00K	0.19	0.20K	1.00K	6.20
Cedar Creek Reservoir Cedar Creek mile 38.0	CHC	1140	2.00K	0.02K	0.02K	0.00	0.22	0.80	0.03	0.10K	1.00K	0.21	0.20K	1.00K	7.80
Wheeler Reservoir Elk River mile 31.0	CHC	1270	2.00K	0.02	0.02K	0.00	0.02K	0.60	0.04	0.20	1.00K	0.15	0.20K	1.00K	8.80
Elk River mile 31.0	LMB	1271	2.00K	0.06	0.02K	0.00	0.02K	0.80	0.02K	0.45	1.00K	0.25	0.20K	1.00K	6.20
Elk River mile 31.0	SMB	1272	2.00K	0.02	0.02K	0.04	0.02K	2.20	0.06	0.49	1.00K	0.27	0.20K	1.00K	12.00
Time Ford Reservoir Elk River mile 135.0	CHC	1136	2.00	0.02K	0.02K	0.00	0.02K	0.80	0.02K	0.10	1.00K	0.18	0.20K	1.00K	6.60
Elk River mile 150.0	CHC	1139	2.00K	0.02K	0.02K	0.00K	0.02K	1.20	0.02K	0.14	1.00K	0.20	0.20K	1.00K	6.40
Nickajack Reservoir Tennessee River mile 425.0	BLC	1130	2.00K	0.35	0.02K	0.00	0.02K	0.20K	0.02K	0.10K	1.00K	0.14	0.20K	1.00K	5.00
Tennessee River mile 457.0	CHC	1129	2.00K	0.16	0.02K	0.01	0.02K	0.80	0.02K	0.10K	1.00K	0.19	0.20K	1.00K	7.00
Chickamauga Reservoir Hiwassee River mile 14.0	LMB	1273	2.00K	0.05	0.02K	0.00	0.02K	0.80	0.09	0.34	1.00K	0.41	0.20K	1.00K	11.00
Hiwassee River mile 14.0	CAT	1274	2.00K	0.02K	0.02K	0.01	0.02K	1.60	0.05	0.40	1.00K	0.16	0.20K	1.00K	7.00
Hiwassee River mile 14.0	C	1275	2.00K	0.02K	0.02K	0.01	0.02K	1.40	0.09	0.28	1.00K	0.50	0.20K	1.00K	11.00

Table 3 (Continued)

Collection Site		Species ^a LABID Antimony Arsenic Beryllium Cadmium Chromium Copper Lead Mercury Nickel Selenium Silver Thallium Zinc													
Nottely Reservoir Nottely River mile 27.5	CHC	1131	2.00K	0.02K	0.02K	0.03	0.02K	1.80	0.04	0.37	1.00K	0.15	0.20K	1.00K	6.60
Parksville Reservoir Ocoee River mile 12.0	CHC	1132	2.00K	0.02K	0.02K	0.01	0.02K	1.00	0.04	0.10K	1.00K	0.83	0.20K	1.00K	6.40
Watts Bar Reservoir X Clinch River mile 20.0	CHC	1147	2.00K	0.16	0.02K	0.00	0.02K	0.20K	0.04	0.10K	1.00K	0.18	0.20K	1.00K	7.60
Emory River mile 10.0	C	1285	2.00K	0.05	0.02K	0.01	0.02K	1.00	0.16	0.18	1.00K	0.46	0.20K	1.00K	22.00
Emory River mile 10.0	BASS	1286	2.00K	0.09	0.02K	0.00	0.02K	1.40	0.02	0.30	1.00K	0.42	0.20K	1.00K	11.00
Emory River mile 10.0	CAT	1287	2.00K	0.09	0.02K	0.00	0.02K	2.40	0.09	0.20	1.00K	0.23	0.20K	1.00K	9.60
Melton Hill Reservoir X Clinch River mile 24.0	CHC	1146	2.00K	0.14	0.02K	0.00	0.11	0.20K	0.03	0.10K	1.00K	0.25	0.20K	1.00K	6.40
Clinch River mile 39.0	CHC	1145	2.00K	0.02	0.02K	0.00K	0.02K	0.20K	0.02K	0.10K	1.00K	0.25	0.20K	1.00K	7.60
Norris Reservoir Clinch River mile 118.8	CHC	1153	2.00K	0.12	0.02K	0.00	0.02K	0.20K	0.05	0.14	1.00K	0.34	0.20K	1.00K	10.00
Cove Creek mile 1.0	CHC	1144	2.00K	0.22	0.02K	0.00	0.23	0.20K	0.07	0.12	1.00K	0.21	0.20K	1.00K	7.60
Powell River mile 34.0	CHC	1152	2.00K	0.03	0.02K	0.00	0.08	0.40	0.47	0.10K	1.00K	0.20	0.20K	1.00K	7.40
Powell River Powell River mile 65.3	CHC	1276	2.00K	0.09	0.02K	0.01	0.02K	1.60	0.04	0.10K	1.00K	0.43	0.20K	1.00K	9.60
Powell River mile 65.3	C-SRD	1277	2.00K	0.12	0.02K	0.01	0.02K	1.00	0.02K	0.12	1.00K	0.42	0.20K	1.00K	14.00
Powell River mile 65.3	SPB	1278	2.00K	0.13	0.02K	0.00	0.02K	1.80	0.02K	0.22	1.00K	0.47	0.20K	1.00K	11.00
Fontana Reservoir L. Tennessee R. mile 62.5	CHC	1128	2.00K	0.02K	0.02K	0.01	0.02K	0.60	0.02K	0.22	1.00K	0.18	0.20K	1.00K	5.20
L. Tennessee R. mile 81.0	CHC	1127	2.00K	0.02K	0.02K	0.01	0.02K	0.80	0.03	0.59	1.00K	0.18	0.20K	1.00K	7.20

Table 3 (Continued)

Collection Site	Species ^a	LAVID	Antimony	Beryllium	Cadmium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Douglas Reservoir													
French Broad R. mile 35.0	BLG	1149	2.00K	0.05	0.02K	0.00	0.02K	0.20K	0.03	0.10K	1.00K	0.09	0.20K
French Broad R. mile 42.0	CHC	1150	2.00K	0.02K	0.02K	0.00	0.02K	0.20K	0.02K	0.13	1.00K	0.02K	0.20K
French Broad R. mile 55.0	CHC	1151	2.00K	0.02K	0.02K	0.00	0.02K	0.40	0.04K	0.13	1.00K	0.10	0.20K
French Broad R. mile 71.4	LMB	1279	2.00K	0.16	0.02K	0.00	0.02K	1.60	0.02	0.36	1.00K	0.21	0.20K
French Broad R. mile 71.4	C	1280	2.00K	0.07	0.02K	0.02	0.02K	1.80	0.15	0.22	1.00K	0.25	0.20K
French Broad R. mile 71.4	CHC	1281	2.00K	0.05	0.02K	0.00	0.16	1.60	0.04	0.16	1.00K	0.11	0.20K
No!chucky River mile 5.3	C	1288	2.00K	0.06	0.02K	0.01	0.02K	1.20	0.14	0.12	1.00K	0.29	0.20K
No!chucky River mile 5.3	LMB	1289	2.00K	0.16	0.02K	0.00	0.02K	2.80	0.05	0.21	1.00K	0.18	0.20K
No!chucky River mile 5.3	CHC	1290	2.00K	0.04	0.02K	0.00	0.02K	2.20	0.05	0.10K	1.00K	0.14	0.20K
Cherokee Reservoir													
Holston River mile 74.0	CHC	1148	2.00K	0.02	0.02K	0.00	0.02K	1.20	0.02K	0.15	1.00K	0.15	0.20K
John Sevier Detention Reservoir													
Holston River mile 110.0	LMB	1282	2.00K	0.18	0.02K	0.00	0.02K	2.60	0.08	0.27	1.00K	0.27	0.20K
Holston River mile 110.0	C	1283	2.00K	0.07	0.02K	0.00	0.02K	1.80	0.07	0.24	1.00K	0.32	0.20K
Holston River mile 110.0	CAT	1284	2.00K	0.06	0.02K	0.01	0.02K	1.40	0.06	0.38	1.00K	0.21	0.20K
Barkley Reservoir													
Cumberland River, midstream	CHC	1133	2.00K	0.02K	0.02K	0.04	0.02K	1.20	0.02K	0.17	1.00K	0.24	0.20K
Cumberland River, upstream	CHC	1134	2.00	0.02	0.02	0.01	0.02	1.40	0.03	0.19	1.00	0.25	0.20

a. Species Abbreviations: CHC=channel catfish; BLL=blue catfish; FHC=flathead catfish; LMB= largemouth bass; SMB=small mouth bass; SPB=spotted bass; C=carp; SRD=shorthead redhorse.

b. K--used to signify less than detection level identified.

Table 4. Concentrations (µg/L) of Pesticides and PCBs in Composited Fish Flesh Samples from Inflow and Reservoir Locations

Collection Site	Species ^a	LABID	Lipid (%)	Aldrin	Dieldrin	Toxophene	Benzene	Chlordane	DDT _r	sulfan	Endro-	Hepta-
							Hexachlo			Endrin		chlor
												PCBs
Normandy Reservoir Duck River mile 251.5	CHC	1135	4.00	0.01K ^b	0.01K	0.50K	0.01K	0.08	0.06	0.01K	0.01K	0.10K
Bear Creek Reservoir Bear Creek mile 76.9	CHC	1143	0.80	0.01K	0.01K	0.50K	0.01K	0.01K	0.01K	0.01K	0.01K	0.10K
Upper Bear Creek Reservoir Bear Creek mile 114.8	CHC	1142	1.90	0.01K	0.01K	0.50K	0.01K	0.01K	0.01K	0.01K	0.01K	0.10K
Little Bear Creek Reservoir L. Bear Creek mile 12.5	CHC	1141	2.30	0.01K	0.01K	0.50K	0.01K	0.01K	0.25	0.01K	0.01K	0.10K
Cedar Creek Reservoir Cedar Creek mile 38.0	CHC	1140	2.30	0.01K	0.01K	0.50K	0.01K	0.01K	0.15	0.01K	0.01K	0.10K
Wheeler Reservoir												
Elk River mile 31.0	CHC	1270	4.90	0.01K	0.01K	0.50K	0.01K	0.04	0.77	0.01K	0.01K	0.80
Elk River mile 31.0	LMB	1271	1.90	0.01K	0.01K	0.50K	0.01K	0.01K	0.32	0.01K	0.01K	0.10K
Elk River mile 31.0	SMB	1272	2.90	0.01K	0.01K	0.50K	0.01K	0.03	0.92	0.01K	0.01K	1.40
Time Ford Reservoir												
Elk River mile 135.0	CHC	1136	1.20	0.01K	0.01K	0.50K	0.01K	0.01	0.12	0.01K	0.01K	0.10K
Elk River mile 150.0	CHC	1139	2.50	0.01K	0.01K	0.50K	0.01K	0.07	0.16	0.01K	0.01K	1.10
Nickajack Reservoir												
Tennessee R. mile 425.0	BLC	1130	15.00	0.01K	0.01K	0.50K	0.01K	0.21	0.10	0.01K	0.01K	1.90
Tennessee R. mile 457.0	CHC	1129	12.00	0.01K	0.01K	0.50K	0.01K	0.25	0.07	0.01K	0.01K	1.30

Table 4 (Continued)

Collection Site	Species ^a	LAB ID	Lipid (%)	Aldrin	Dieldrin	Toxophene	Benzene	Hexachloro	Chlordane	DDTr	Endosulfan	Endrin	Hepta-chlor	PCBs
Chickamauga Reservoir														
Hiwassee River mile 14.0	LNB	I273	0.70	0.0IK	0.0IK	0.50K	0.0IK	0.0IK	0.0IK	0.0IK	0.0IK	0.0IK	0.50	
Hiwassee River mile 14.0	CAT	I274	3.10	0.0IK	0.0IK	0.50K	0.0IK	0.05	0.0IK	0.0IK	0.0IK	0.0IK	1.00	
Hiwassee River mile 14.0	C	I275	7.30	0.0IK	0.06	0.50K	0.0IK	0.15	0.05	0.0IK	0.0IK	0.0IK	1.90	
Notely Reservoir														
Notely River mile 27.5	CHC	I131	2.40	0.0IK	0.0IK	0.50K	0.0IK	0.0IK	0.04	0.0IK	0.0IK	0.0IK	0.10K	
Parksville Reservoir														
Ocoee River mile 12.0	CHC	I132	3.20	0.0IK	0.0IK	0.50K	0.0IK	0.0IK	0.07	0.0IK	0.0IK	0.0IK	0.90	
Watts Bar Reservoir														
Clinch River mile 20.0	CHC	I147	10.00	0.0IK	0.0IK	0.50K	0.0IK	0.25	0.09	0.0IK	0.0IK	0.0IK	2.10	
Emory River mile 10.0	C	I285	3.10	0.0IK	0.0IK	0.50K	0.0IK	0.02	0.0IK	0.0IK	0.0IK	0.0IK	0.60	
Emory River mile 10.0	BASS	I286	0.20	0.0IK	0.0IK	0.50K	0.0IK	0.0IK	0.04	0.0IK	0.0IK	0.0IK	0.50	
Emory River mile 10.0	CAT	I287	3.70	0.0IK	0.0IK	0.50K	0.0IK	0.07	0.04	0.0IK	0.0IK	0.0IK	0.80	
Melton Hill Reservoir														
Clinch River mile 24.0	CHC	I146	7.60	0.0IK	0.0IK	0.50K	0.0IK	0.16	0.0IK	0.0IK	0.0IK	0.0IK	1.20	
Clinch River mile 39.0	CHC	I145	4.80	0.0IK	0.0IK	0.50K	0.0IK	0.16	0.16	0.0IK	0.0IK	0.0IK	2.00	
Norris Reservoir														
Clinch River mile 118.8	CHC	I153	3.80	0.0IK	0.0IK	0.50K	0.0IK	0.03	0.03	0.0IK	0.0IK	0.0IK	0.60	
Gove Creek mile 1.0	CHC	I144	7.10	0.0IK	0.0IK	0.50K	0.0IK	0.04	0.15	0.0IK	0.0IK	0.0IK	0.10K	
Powell River mile 34.0	CHC	I152	3.40	0.0IK	0.0IK	0.50K	0.0IK	0.03	0.03	0.0IK	0.0IK	0.0IK	0.10K	
Powell River														
Powell River mile 65.3	CHC	I276	5.50	0.0IK	0.0IK	0.50K	0.0IK	0.02	0.0IK	0.0IK	0.0IK	0.0IK	0.10K	
Powell River mile 65.3	C-SRD	I277	4.50	0.0IK	0.0IK	0.50K	0.0IK	0.03	0.03	0.0IK	0.0IK	0.0IK	0.60	
Powell River mile 65.3	SPB	I278	0.40	0.0IK	0.0IK	0.50K	0.0IK	0.01K	0.01K	0.0IK	0.0IK	0.0IK	0.10K	

Table 4 (Continued)

Collection Site	Species ^a	LABID	Lipid (%)	Aldrin	Dieldrin	Toxophene	Benzene	Chlordane	DDT _{tr}	Endosulfan	Heptachlor	Endrin	Hepta-chlor	PCBs
Fontana Reservoir														
L. Tennessee R. mile 62.5	CHC	1128	2.70	0.01K	0.01K	0.50K	0.01K	0.01K	0.01K	0.01K	0.01K	0.01K	0.10K	
L. Tennessee R. mile 81.0	CHC	1127	1.90	0.01K	0.01K	0.50K	0.01K	0.01K	0.04	0.01K	0.01K	0.01K	0.10K	
Douglas Reservoir														
French Broad R. mile 35.0	BLC	1149	4.90	0.01K	0.01K	0.50K	0.01K	0.04	0.13	0.01K	0.01K	0.01K	0.10K	
French Broad R. mile 42.0	CHC	1150	7.00	0.01K	0.01K	0.50K	0.01K	0.07	0.19	0.01K	0.01K	0.01K	0.80	
French Broad R. mile 55.0	CHC	1151	5.60	0.01K	0.01K	0.50K	0.01K	0.08	0.15	0.01K	0.01K	0.01K	0.90	
French Broad R. mile 71.4	LMB	1279	1.40	0.01K	0.01K	0.50K	0.01K	0.02	0.05	0.01K	0.01K	0.01K	0.10K	
French Broad R. mile 71.4	C	1280	3.80	0.01K	0.01K	0.50K	0.01K	0.02	0.16	0.01K	0.01K	0.01K	1.10	
French Broad R. mile 71.4	CHC	1281	1.60	0.01K	0.01K	0.50K	0.01K	0.01	0.04	0.01K	0.01K	0.01K	0.10K	
Nolichucky River mile 5.3	C	1288	4.00	0.01K	0.01K	0.50K	0.01K	0.04	0.20	0.01K	0.01K	0.01K	0.80	
Nolichucky River mile 5.3	LMB	1289	2.30	0.01K	0.01K	0.50K	0.01K	0.03	0.11	0.01K	0.01K	0.01K	1.00	
Nolichucky River mile 5.3	CHC	1290	2.40	0.01K	0.01K	0.50K	0.01K	0.01K	0.01K	0.01K	0.01K	0.01K	0.10K	
Cherokee Reservoir														
Holston River mile 74.0	CHC	1148	2.80	0.01K	0.01K	0.50K	0.01K	0.09	0.06	0.01K	0.01K	0.01K	0.80	
John Sevier Detention Reservoir														
Holston River mile 110.0	LMB	1282	0.70	0.01K	0.01K	0.50K	0.01K	0.01K	0.01K	0.01K	0.01K	0.01K	0.10K	
Holston River mile 110.0	C	1283	6.40	0.01K	0.01K	0.50K	0.01K	0.08	0.01K	0.01K	0.02	0.01K	1.00	
Holston River mile 110.0	CAT	1284	6.40	0.01K	0.01K	0.50K	0.01K	0.13	0.01K	0.01K	0.01K	0.01K	1.60	
Barkley Reservoir														
Cumberland R., midstream	CHC	1133	0.50	0.01K	0.01K	0.50K	0.01K	0.01K	0.08	0.01K	0.01K	0.01K	0.10K	
Cumberland R., upstream	CHC	1134	1.50	0.01K	0.01K	0.50K	0.01K	0.03	0.16	0.01K	0.01K	0.01K	0.10K	

a. Species Abbreviations: CHC=channel catfish; BLL=blue catfish; FHC=fathead catfish; LMB= largemouth bass; SMB=small mouth bass; SPB=spotted bass; C=carp; SRD=shorthead redhorse.

b. K--used to signify less than detection level identified.

Table 5. Selected 1987 Results from Reservoir and Inflow Sites Which Show Need for Further Evaluation Based on Preselected Tiered Criteria (see table 1)

Location	Species	Tier 1 ^a		Tier 2	
		Contaminants which show need to conduct detailed studies of individual fish to resample at screening effort to verify results from 1987 (µg/g)	Contaminants which show need to conduct detailed studies of individual fish to define extent of contaminant problem in the reservoir (µg/g)	Contaminants which show need to conduct detailed studies of individual fish to resample at screening effort to verify results from 1987 (µg/g)	Contaminants which show need to conduct detailed studies of individual fish to define extent of contaminant problem in the reservoir (µg/g)
Duck River--Normandy Reservoir DRM 251	Channel catfish	Chlordane 0.1b	-	-	-
Elk River--Tims Ford Reservoir ERM 150	Channel catfish	PCBs 1.1	-	-	-
Elk River--mile 31.0	Small mouth buffalo	PCBs 1.4, mercury 0.5	-	-	-
Elk River--mile 31.0	CatfishC	PCBs ~0.8	-	-	-
Tennessee River--Nickajack Reservoir TRM 425	Blue catfish	-	PCBs 1.9, chlordane 0.21	-	-
Tennessee River--Nickajack Reservoir TRM 457	Channel catfish	PCBs 1.3	chlordane 0.25	-	-
Ocoee River--Parksville Reservoir ORM 12	Channel catfish	PCBs ~0.9, selenium 0.8	-	-	-
Hiwassee River--mile 14.0	Carp	chlordane 0.15	PCBs 1.9	-	-
Hiwassee River--mile 14.0	Channel catfish	PCBs 1.0, mercury ~0.4	-	-	-
Emory River--mile 7.5	CatfishC	PCBs ~0.8	-	-	-
Clinch River--Melton Hill Dam tailrace CRM 20	Channel catfish	-	PCBs 2.1, chlordane 0.26	-	-
Clinch River--Melton Hill Reservoir CRM 24	Channel catfish	PCBs 1.2, chlordane 0.16	-	-	-
Clinch River--Melton Hill Reservoir CRM 39	Channel catfish	chlordane 0.16	PCBs 2.0	-	-
Little Tennessee River--Fontana					
Reservoir LTRM 81	Channel catfish	mercury 0.5	-	-	-
French Broad River--mile 71.4	Carp	PCBs 1.1	-	-	-
NoLichucky River--mile 5.3	Carp	PCBs ~0.8	-	-	-
NoLichucky River--mile 5.3	Largemouth bass	PCBs 1.0	-	-	-

Table 5 (Continued)

Location	Species		Contaminants which show need to conduct detailed studies of individual fish to define extent of contaminant problem in the reservoir ($\mu\text{g/g}$)
	Tier 1 ^a	Tier 2	
French Broad River—Douglas Reservoir FBRM 42	Channel catfish	PCBs ~0.8	
French Broad River—Douglas Reservoir FBRM 55	Channel catfish	PCBs ~0.9	
Holston River—Cherokee Reservoir HRM 73	Channel catfish	PCBs ~0.8	
Holston River—mile 110.0	Catfish ^c	chlordane 0.13 PCBs 1.6	

a. The ~ symbol has been used to identify those contaminants found at levels slightly below the preselected tiered level.

b. This value would be 0.8 $\mu\text{g/g}$ if isomers were totaled according to FDA, 1987.

c. Catfish composite composed of both channel and blue catfish.

Table 6. Highest and Second Highest Concentrations ($\mu\text{g/g}$) of Each Contaminant by Collection Site Found in Fish Tissue Screening Studies in 1987

Parameter	Highest Concentration Found			Second Highest Concentration Found		
	Level	Location ^a	Sample	Level	Location ^a	Sample
Antimony	ND	-	-	-	-	-
Arsenic	0.35	TRM 425.0	cat	0.22	CCM 1.0	cat
Beryllium	ND	-	-	-	-	-
Cadmium	0.04	ERM 31.0	rough	0.03	NoTRM 27.5	cat
	0.04	CuRM-mid-Barkley	cat			
Chromium	0.23	CCM 1.0	cat	0.22	CeCM 38.0	cat
Copper	2.8	NoIRM 5.3	game	2.6	HRM 110	game
Lead	0.16	EmRM 10.0	rough	0.15	FBRM 71.4	rough
Mercury	0.59	LTRM 81.0	cat	0.49	ERM 31.0	rough
Nickel	ND	-	-	-	-	-
Selenium	0.83	ORM 12.0	cat	0.50	HIRM 14.0	cat
Silver	ND	-	-	-	-	-
Thallium	ND	-	-	-	-	-
Zinc	26	HRM 110	rough	22	EmRM 10.0	rough
Aldrin	ND	-	-	-	-	-
BHC	ND	-	-	-	-	-
Chlordane	0.25	TRM 457.0	cat	0.21	TRM 425.0	cat
	0.25	CRM 20.0	cat			
DDTr	0.92	ERM 31.0	rough	0.77	ERM 31.0	cat
Dieldrin	ND	-	-	-	-	-
Endsulfan	ND	-	-	-	-	-
Endrin	ND	-	-	-	-	-
Heptachlor	ND	-	-	-	-	-
Toxaphene	ND	-	-	-	-	-
PCBs	2.1	CRM 20.0	cat	2.0	CRM 39.0	cat

a. Location abbreviations:

- TRM—Tennessee River mile
- CCM—Cove Creek mile
- ERM—Elk River mile
- NoTRM—Nottely River mile
- CuRM—Cumberland River mile
- CeCM—Cedar Creek mile
- NoIRM—Nolichucky River mile
- HRM—Holston River mile
- EmRM—Emory River mile
- FBRM—French Broad River mile
- LTRM—Little Tennessee River mile
- ORM—Ocoee River mile
- HIRM—Hiwassee River mile
- CRM—Clinch River mile

Table 7. Listing of Collection Sites Which Require Some Type of Examination in Autumn
 (September-December) 1988

Location	Tier 1	Tier 2	Site Planned for Collection		
	Results from 1987 Show Need to Resample at Screening Level	Show Need to Conduct Intensive Study	in 1987 but Efforts Unsuccessful	Collection Due from Rotation	
Kentucky Reservoir					
Tennessee River mile 30			X		
Tennessee River mile 60			X		
Big Sandy Creek mile 5			X		
Tennessee River mile 100			X		
Tennessee River mile 135			X		
Tennessee River mile 173			X		
Tennessee River mile 200			X		
Normandy Reservoir					
Duck River mile 251		X			
Pickwick Reservoir					
Tennessee River mile 210			X		
Tennessee River mile 235			X		
Tennessee River mile 255			X		
Wilson Reservoir					
Tennessee River mile 260			X		
Tennessee River mile 270			X		
Tennessee River mile 270			X		
Wheeler Reservoir					
Tennessee River mile 275			X		
Tennessee River mile 300			X		
Tennessee River mile 339			X		
Tims Ford Reservoir					
Elk River mile 135			X		
Elk River mile 150			X		

Table 7 (Continued)

Location	Tier 1		Tier 2		Site Planned for Collection	
	Results from 1987 Show Need to Resample at Screening Level	Show Need to Conduct Intensive Study	Results from 1987 in 1987 but Efforts Unsuccessful	Collection Due from Rotation		
Guntersville Reservoir					X	
Tennessee River mile 350					X	
Tennessee River mile 382					X	
Tennessee River mile 415					X	
Nickajack Reservoir					X	
Tennessee River mile 425					X	
Tennessee River mile 457					X	
Hiwassee Res. Lower					X	
Chatuge Reservoir, lower					X	
Ocoee (Parksville) ORM 12.0			X		X	
Blue Ridge Res. Lower					X	
Clinch River mile 20					X	
Melton Hill Reservoir					X	
Clinch River mile 24					X	
Clinch River mile 39					X	
Fontana Reservoir					X	
LTRM 63					X	
LTRM 81					X	
Cherokee Reservoir, HRM 73			X			
Watauga Reservoir, middle						X
Barkley Reservoir, lower						X
Cheatum Reservoir, middle						X
Old Hickory Reservoir, lower						X
middle						X

APPENDIXES

APPENDIX A

LISTING OF COLLECTION SITES INCLUDED IN THE VALLEY-WIDE
FISH TISSUE STUDY

Table A-1. Listing of Collection Sites Included in the Valley-Wide Fish Tissue Study
Including Needed Frequency of Collections and Existence of Historic Information
from Each General Area (see footnote for explanation of abbreviations)

Collection Sites	Needed Frequency (Year)	Sampled Prior to 1984	Calendar Year				
			1984	1985	1986	1987	1988
Lower Tennessee River							
Tennessee River mile (TRM) 7	3	M,*0	DUK	M,0	M,0	OS-O,M	DNN
TRM 21	3	M,0	DUK	DUK	M,0	OS-O,M	DNN
Kentucky Reservoir^a							
TRM 30	3	DUK	DUK	DUK	O	OS-O,M	DN
TRM 60	3	M	DUK	DUK	DUK	OS-O,M	DN
Big Sandy Creek mile 5	3	DUK	DUK	DUK	DUK	OS-O,M	DN
TRM 100	3	M,0	DUK	M,0	DUK	OS-O,M	DN
TRM 135	3	DUK	DUK	M,0	DUK	OS-O,M	DN
TRM 173	3	DUK	DUK	DUK	DUK	OS-M	DN
TRM 200	3	DUK	DUK	O	DUK	OS-O,M	DN
Duck River							
Duck River mile 18.5	SWMS Annual	DUK	M,0	DUK	M,0	OS-O,M	OS-O,M
Normandy Reservoir							
Duck River mile 251	4	DUK	DUK	M,0	DUK	VW-O,M	Resample Tier 1
Pickwick Reservoir							
TRM 210	3	M,0	DUK	M,0	DUK	D-NN	D-N
TRM 235	3	M,0	DUK	M,0	DUK	D-NN	D-N
TRM 255	3	M,0	M,0	M,0	O	D-NN	D-N
Bear Creek Reservoir							
Bear Creek lower	4	DUK	DUK	DUK	VW-O,M	D-NN	
Upper Bear lower	4	DUK	DUK	DUK	VW-O,M	D-NN	
Little Bear lower	4	DUK	DUK	DUK	VW-O,M	D-NN	
Cedar Creek lower	4	DUK	DUK	DUK	VW-O,M	D-NN	
Wilson Reservoir							
TRM 260	3	M,0	M,0	O	O	OS-O	D-N
TRM 270	3	M,0	M,0	O	O	OS-O	D-N
Wheeler Reservoir							
TRM 275	3	DUK	DUK	M,0	DUK	D-NN	D-N
TRM 300	3	DUK	DUK	M,0	DUK	D-NN	D-N
TRM 339	3	DUK	DUK	M,0	DUK	OS-R,NP	D-N
Elk River							
Elk River mile 31.0	SWMS Annual	DUK	DUK	DUK	M,0	OS-M,O	OS-M,O

Table A-1 (Continued)

Collection Sites	Needed Frequency (Year)	Sampled Prior to 1984	Calendar Year				
			1984	1985	1986	1987	1988
Tims Ford Res. ERM 135	3	M,O	DUK	DUK	DUK	VW-M,O	Resample Tier 1
Tims Ford Res. ERM 150	3	DUK	DUK	DUK	DUK	VW-M,O	Resample Tier 1
Woods Res. Lower	3	M,O	DUK	0	0	OS-O	D-NN
Guntersville Reservoir							
TRM 350	3	DUK	DUK	M,O	DUK	OS-R,NP	D-N
TRM 382	3	DUK	DUK	M,O	DUK	OS-R,NP	D-N
TRM 415	3	DUK	DUK	M,O	DUK	OS-M,O	D-N
Nickajack Reservoir							
TRM 425	3	M,O	DUK	DUK	DUK	VW-M,O	Tier 2
TRM 457	3	M,O	DUK	DUK	DUK	VW-M,O	Tier 2
Chickamauga Reservoir							
Lower	ONP Annual	M,O	M,O	DUK	DUK	OS-M,O	OS-M,O
Hiwassee River (Impounded)	ONP Annual	M,O	DUK	DUK	DUK	OS-M,O	OS-M,O
Upper	ONP Annual	DUK	DUK	DUK	DUK	OS-M,O	OS-M,O
Hiwassee River							
Hiwassee River mile 14	SWMS Annual	DUK	DUK	DUK	M,O	OS-M,O	OS-M,O
Hiwassee Res. Lower	4	DUK	DUK	DUK	DUK	D-N	D-N
Chatuge Res. Lower	4	DUK	DUK	DUK	DUK	D-N	D-N
Notely Res. Lower	4	DUK	DUK	DUK	DUK	VW-M,O	D-NN
Ocoee (Parksville) Lower	3	DUK	M,O	DUK	DUK	VW-M,O	Resample Tier 1
Blue Ridge Lower	4	DUK	DUK	DUK	DUK	D-N	D-N

Table A-1 (Continued)

Collection Sites	Needed Frequency (Year)	Sampled Prior to 1984	Calendar Year				
			1984	1985	1986	1987	1988
Watts Bar Reservoir							
TRM 532	3	M,O	M,O	DUK	DUK	D-N	OS-O
TRM 567	3	DUK	M,O	DUK	DUK	OS-O	OS-O
TRM 602	3	DUK	DUK	O	O	OS-O	OS-O
Clinch River							
Clinch River mile 20	3	DUK	M,O	DUK	DUK	VW-M,O	Tier 2
Emory River mile 7.5	SWMS Annual	DUK	DUK	DUK	M,O	OS-M,O	OS-M,O
Melton Hill Res. CRM 24	4	DUK	DUK	DUK	DUK	VW-M,O	Tier 2
Melton Hill Res. CRM 39	4	DUK	DUK	DUK	DUK	VW-M,O	Tier 2
Norris Res. Lower	4	DUK	DUK	DUK	DUK	VW-M,O	D-NN
Norris Res. Powell Arm Mid	4	M	DUK	DUK	DUK	VW-M,O	D-NN
Norris Res. Clinch Arm Mid	4	DUK	DUK	DUK	DUK	VW-M,O	D-NN
Powell River mile 65.2	SWMS Annual	M,O	DUK	DUK	M,O	OS-M,O	OS-M,O
Fort Loudoun Reservoir							
TRM 604	3	O	DUK	O	O	D-NN	OS-O
Little River 3.0	3	O	M,O	O	O	OS-O	OS-O
TRM 651	3	O	M,O	O	O	D-NN	OS-O
Little Tennessee River							
Tellico Res. LTRM 1.0	3	DUK	DUK	O	O	OS-O	OS-O
Tellico Res. LTRM 11	3	M,O	DUK	O	O	OS-O	OS-O
Chilhowee Res. Lower	3	DUK	DUK	DUK	O	OS-O	D-NN
Calderwood Res. Lower	4	DUK	DUK	DUK	DUK	OS-O	D-NN
Cheoah Res. Lower	4	DUK	DUK	DUK	DUK	OS-O	D-NN
Santeetlah Res. Lower	4	DUK	DUK	DUK	DUK	OS-O	D-NN
Fontana Res. LTRM 62	4	DUK	DUK	DUK	DUK	VW-M,O & OS-O	Resample Tier 1
Fontana Res. LTRM 81	4	DUK	DUK	DUK	DUK	VW-M,O & OS-O	Resample Tier 1
French Broad River							
Douglas Res. FBRM 35	3	DUK	M,O	DUK	DUK	VW-M,O	Resample Tier 1
Douglas Res. FBRM 42	3	DUK	DUK	DUK	DUK	VW-M,O	Resample Tier 1
Douglas Res. FBRM 55	3	DUK	M,O	DUK	DUK	VW-M,O	Resample Tier 1

Table A-1 (Continued)

Collection Sites	Needed Frequency (Year)	Sampled Prior to 1984	Calendar Year				
			1984	1985	1986	1987	1988
French Broad River mile 71.4	SWMS Annual	M,O	DUK	DUK	M,O	OS-M,O	OS-M,O
Nolichucky River mile 5.3	SWMS Annual	DUK	DUK	DUK	M,O	OS-M,O	OS-M,O
Holston River							
Cherokee Res. Lower	3	DUK	DUK	DUK	DUK	OS-M,O	?
Cherokee Res. HRM 73	3	M,O	M,O	DUK	DUK	D-N	Resample Tier 1
Cherokee Res. Upper	3	M,O	M,O	DUK	DUK	OS-M,O	?
Holston River mile 110	SWMS Annual	DUK	DUK	DUK	M,O	OS-M,O	OS-M,O
Fort Pat. Res. Lower	4	DUK	DUK	M,O	DUK	OS-M,O	D-NN
Boone Res.-Wat. R. Side	3	M,O	M,O	M,O	DUK	OS-M,O	D-NN
Boone Res.-So. Hol. R. Side	3	M,O	M,O	M,O	DUK	OS-M,O	D-NN
Watauga Res.--Middle	4	DUK	DUK	DUK	DUK	D-N	D-N
South Holston Res. Lower	4	DUK	M,O	M,O	DUK	OS-M,O	D-NN
Cumberland River							
Barkley Res. Lower	3	DUK	DUK	DUK	DUK	D-N	D-N
Barkley Res. Middle	3	DUK	DUK	DUK	DUK	VW-M,O	D-NN
Barkley Res. Upper	3	DUK	DUK	DUK	DUK	VW-M,O	D-NN
Cheatham Res. Middle	3	DUK	DUK	DUK	DUK	D-N	D-N
Old Hickory Res. Lower	3	DUK	DUK	DUK	DUK	D-N	D-N
Old Hickory Res. Upper	3	DUK	DUK	DUK	DUK	D-N	D-N

*Abbreviation:

- M = Metals (One or more heavy metals)
- O = Organic (One or more organic compounds)
- DUK = Data unknown, assumed that no data exist
- OS = Other study to provide information on metals (M) and/or organics (O)
- SWMS = Surface Water Monitoring Strategy program
- OS-R, NP = Other study recommended, not planned
- ONP = Office of Nuclear Power (TVA)
- D-N = Data needed
- D-NN = Data not needed
- VW-M,O = Valley-wide Fish Tissue Study Metals and Organics

- a. Two sites were added to Kentucky Reservoir in 1988 to provide more thorough coverage (Big Sandy Creek and TRM 173). In 1987 it was assumed that fish for tissue analysis would be collected as part of another study on Kentucky Reservoir. Because this did not materialize to the extent expected, all sites will be sampled in 1988 as part of this study.

APPENDIX B

ANALYTICAL METHODOLOGY FOR VALLEY-WIDE

FISH TISSUE STUDY

Table B-1. Analytical Methodology for Valley-Wide Fish Tissue Study

Parameter	Reference ^a	Methodology	Detection Limit ((μ g/g)
Preparation of sample for analysis	Reference 1, Method 41.200.3	Dry ice blending of 5-fish composite for metals; grinding of 5-fish composite for pesticides, DDT _r , and PCBs	-
Digestion for metals	Reference 1, Method 41.200.2	HNO ₃ -H ₂ O ₂	-
Antimony	Reference 1, Method 30.200.2	ICP	2
Arsenic	Reference 1, Method 41.206.1	AA-furnace	0.02
Beryllium	Reference 1, Method 30.200.2	ICP	0.02
Cadmium	Reference 1, Method 30.200.2	ICP	0.1
Chromium	Reference 1, Method 41.221.1	AA-Furnace	0.02
Copper	Reference 1, Method 30.200.2	ICP	0.2
Lead	Reference 1, Method 41.244.1	AA-Furnace	0.02
Mercury	Reference 2, pages 34-37	Cold vapor	0.1
Nickel	Reference 1, Method 30.200.7	ICP	1
Selenium	Reference 1, Method 41.276.1	AA-Furnace	0.02
Silver	Reference 1, Method 30.200.2	ICP	0.2
Thallium	Reference 1, Method 30.200.2	ICP	1
Zinc	Reference 1, Method 30.200.7	ICP	0.1
PCBs	Reference 1, Method 41.418.1	Mechanical dispersion Sulfuric acid cleanup GC/EC	0.1
DDTr	Reference 1, Method 41.418.1	Mechanical dispersion Sulfuric acid cleanup GC/EC	0.01
Pesticides	Reference 3	Mechanical dispersion GCP cleanup, GC/EC	Various

a. References

1. Laboratory Branch Quality Manual.
2. "Interim Methods for the Sampling and Analysis of Priority Pollutants in Sediments and Fish Tissue," EPA 600/4-81-055, Environmental Protection Agency, Cincinnati, Ohio, October 1980.
3. "Extraction and Analysis of Priority Pollutants in Biological Tissue," Method ppb 12/83, U.S. Environmental Protection Agency, Environmental Services Division, Region IV, Analytical Support Branch, Athens, Georgia.